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UNIVERSITY OF CALIFORNIA

INSTITUTE OF GEOPHYSICS

ANNUAL SUMMARY REPORT

MARINE GRAVITY RESEARCH

by

L. B. Slichter, J. C. Harrison, and G. L. Brown

Contract Nonr-233(19)

MR081-206 Code 416

September 1953 - September 1954

LOS ANGELES 24, CALIFORNIA

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Annual Summary Report
Contract No. Nonr 233(19)

MARINE GRAVITY RESEARCH

Project Director: L. B. Slichter

Report prepared by: J. C. Harrison and G. L. Brown

September 1953 - September 1954

ANNUAL SUMMARY REPORT ON MARINE GRAVITY CONTRACT, Nonr-233(19)

September 1953 - September 1954

During the closing months of 1953 and the early months of 1954, the Institute of Geophysics paid considerable attention to the possibility of devising a vibrating string gravimeter for the measurement of gravity at sea. Sir Edward Bullard, director of the National Physical Laboratory, England, was able to offer valuable advice on this subject during his visit early in November, on the basis of experience gained at the Department of Geodesy and Geophysics, Cambridge, England, in developing such an instrument.* The properties of various geometrical arrangements of the hinge, weight and string with regard to drifts caused by changes of temperature and of the length of the string were investigated theoretically by Dr. Margery Jarabin, who also made a study of the possible application of crossed-strip hinges to an instrument of this nature. A simple experimental set-up for determining the Q factor of a vibrating string was constructed by Mr. Glenn Brown and several preliminary experiments made.

Active work on the vibrating string gravimeter ceased at the beginning of March with the independent, but nearly simultaneous, arrival of Mr. B. C. Browne, head of the Department of Geodesy and Geophysics, Cambridge, and of the Vening Meinesz pendulum apparatus belonging to the Royal Dutch Geodetic Commission. The pendulum apparatus is on limited loan and it was decided to place maximum effort in making use of this apparatus while it was available, at the expense of progress with the

* For a description of this instrument see Gilbert, R. L. G. Proc. Phys. Soc. B. IXII, 445-454. 1949

new instrument. Also it was suggested that it might be possible fairly soon to purchase a prototype of the Cambridge instrument, thus saving much development work.

Arrangements for the loan of the pendulum apparatus had been made in the summer of 1953, through Prof. F. A. Vening Meinesz. It had also been arranged that Dr. J. C. Harrison would come over from Cambridge, England, to work on the contract and during Dr. Harrison's transit through Washington D. C. in November 1953, Dr. Carl Alexis of O.N.R. had arranged for the loan of a Loran precision crystal oscillator from the Coast Guard, and of a frequency divider unit from the Naval Research Laboratories. A power supply and amplifier unit had been built at U.C.L.A. prior to March 1954 to operate with these units to drive the synchronous motors used in timing the pendulums.

The Meinesz pendulum apparatus had suffered minor damage in shipment but this was quickly repaired. Through the courtesy of the Commanding Officer of the Naval Electronics Laboratory, San Diego, Captain H. E. Bernstein, it was arranged to use U. S. Submarine Baya for a week at the end of March for a trial of the apparatus and to gain experience in the installation and use of the apparatus on board a submarine, under the guidance of Mr. Browne. The apparatus, together with a speedometer and an automatic depth recorder kindly lent by the Scripps Institute of Oceanography, was installed over the weekend 27/28th March by Mr. B. C. Browne, Dr. Harrison and Mr. Glenn Brown and ten observations of gravity at sea were made in the succeeding week. Mr. B. C. Browne returned to England directly after this expedition. During this, and all succeeding gravity expeditions a great deal of help was received from the Marine Physical Laboratory, especially from the director, Sir Charles Wright and from Dr. F. N. Spiess.

An analysis of the results of this expedition showed that the depth recorder and speedometer were worth carrying on gravity expeditions and work went ahead at U.C.L.A. with the necessary instrumentation though it is still necessary to borrow certain items from the Scripps Institution owing to the delays caused by long delivery times.

U.S.S. Baya was again available for gravity work during the week beginning 28th June and a survey of Seamount Jasper was carried out, during which 19 new stations were occupied. The Commander of Submarine Flotilla One kindly allowed the installation of the gravity apparatus on U.S.S. Rasher during her transit from San Diego to Port Angeles, Washington, between 17th and 26th July and during her return to San Diego between 7th and 12th September, and a further 38 stations were made. Dr. Harrison and Mr. Glenn Brown were accompanied by Dr. Spiess of the Marine Physical Laboratory for the survey of Seamount Jasper and for the transit of the U.S.S. Rasher from San Diego to Astoria (en route for Port Angeles).

The station positions have been planned, after consultation with the Scripps Institute of Oceanography and the Oceanographic section of the Naval Electronics Laboratory, to coordinate with the programs of these bodies and to throw the greatest possible light on structural problems near to the west coast of the United States. The computations for the first survey including isostatic reductions, are complete and the calculations for the other stations are proceeding steadily.

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